

Features

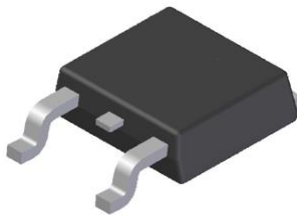
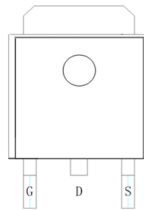
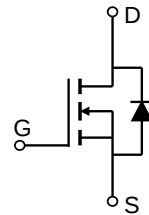
- Ultra-low ON-resistance, $R_{DS(ON)}$
- Low Gate Charge
- 100% UIS Tested
- 100% ΔV_{ds} Tested
- Halogen-free; RoHS-compliant
- AEC-Q101 Qualified

Applications

- Load Switch
- PWM Application
- General Automotive Application

Product Summary

Parameters	Value	Unit
V_{DSS}	60	V
$V_{GS(th)}_{Typ}$	1.7	V
$I_D(@V_{GS}=10V)$	65	A
$R_{DS(ON)}_{Typ}(@V_{GS}=10V)$	8.1	mΩ
$R_{DS(ON)}_{Typ}(@V_{GS}=4.5V)$	11	mΩ


TO-252-3L

Pin Assignment

Schematic Diagram
Ordering Information

Device	Marking	MSL	Form	Package	Reel(pcs)	Per Carton (pcs)
JMSL0612NKQ-13	SL0612NQ	1	Tape&Reel	TO-252-3L	2500	25000

Absolute Maximum Ratings (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit
V_{DS}	Drain-to-Source Voltage	60	V
V_{GS}	Gate-to-Source Voltage	± 20	V
I_D	Continuous Drain Current	$T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	A
I_{DM}	Pulsed Drain Current ⁽¹⁾	Refer to Fig.4	A
E_{AS}	Single Pulsed Avalanche Energy ⁽²⁾	60	mJ
P_D	Power Dissipation	$T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	W
T_J, T_{STG}	Junction & Storage Temperature Range	-55 to 175	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Max	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient ⁽³⁾	41	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.7	

Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
V _{(BR)DSS}	Drain-Source Breakdown Voltage	I _D = 250μA, V _{GS} = 0V	60	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 48V, V _{GS} = 0V	-	-	1.0	μA
I _{GSS}	Gate-Body Leakage Current	V _{DS} = 0V, V _{GS} = ±20V	-	-	±100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	1.2	1.7	2.2	V
R _{DS(ON)}	Static Drain-Source ON-Resistance ⁽⁴⁾	V _{GS} = 10V, I _D = 20A	-	8.1	11	mΩ
		V _{GS} = 4.5V, I _D = 15A	-	11	14	mΩ
Dynamic Characteristics						
R _g	Gate Resistance	f = 1MHz	-	2.1	-	Ω
C _{iss}	Input Capacitance	V _{GS} = 0V, V _{DS} = 30V, f = 1MHz	-	834	1251	pF
C _{oss}	Output Capacitance		-	376	565	pF
C _{rss}	Reverse Transfer Capacitance		-	24	48	pF
Q _g	Total Gate Charge	V _{GS} = 0 to 10V V _{DS} = 30V, I _D = 20A	-	15	-	nC
Q _{gs}	Gate Source Charge		-	2.9	-	nC
Q _{gd}	Gate Drain("Miller") Charge		-	3.4	-	nC
Switching Characteristics						
t _{d(on)}	Turn-On DelayTime	V _{GS} = 10V, V _{DD} = 30V I _D = 20A, R _{GEN} = 3Ω	-	6.0	-	ns
t _r	Turn-On Rise Time		-	19	-	ns
t _{d(off)}	Turn-Off DelayTime		-	17	-	ns
t _f	Turn-Off Fall Time		-	5.4	-	ns
Body Diode Characteristics						
I _S	Maximum Continuous Body Diode Forward Current		-	-	65	A
I _{SM}	Maximum Pulsed Body Diode Forward Current		-	-	259	A
V _{SD}	Body Diode Forward Voltage	V _{GS} = 0V, I _S = 20A	-		1.2	V
trr	Body Diode Reverse Recovery Time	I _F = 20A, di/dt = 100A/us	-	22	-	ns
Qrr	Body Diode Reverse Recovery Charge		-	11	-	nC

- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
 2. E_{AS} condition: Starting $T_J = 25^\circ\text{C}$, $V_{DD} = 30\text{V}$, $V_{GS} = 10\text{V}$, $R_G = 25\text{ohm}$, $L = 3\text{mH}$, $I_{AS} = 6.3\text{A}$, $V_{DD} = 0\text{V}$ during time in avalanche.
 3. $R_{\theta JA}$ is measured with the device mounted on a 1inch^2 pad of 2oz copper FR4 PCB.
 4. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 0.5\%$.

Typical Performance Characteristics

Figure 1: Power De-rating

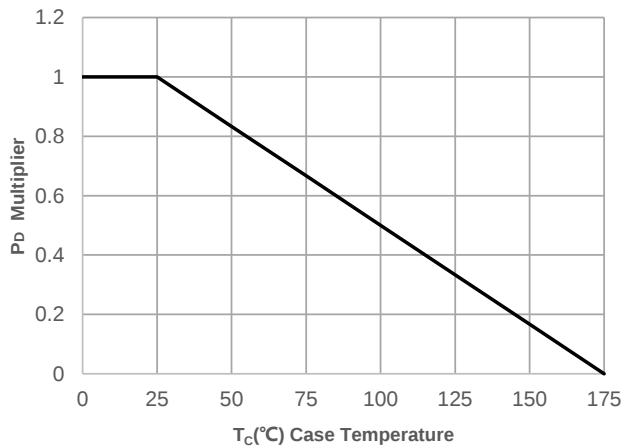


Figure 2: Current De-rating

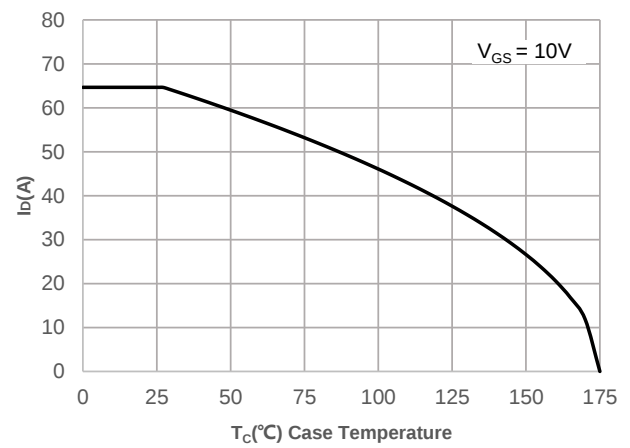


Figure 3: Normalized Maximum Transient Thermal Impedance

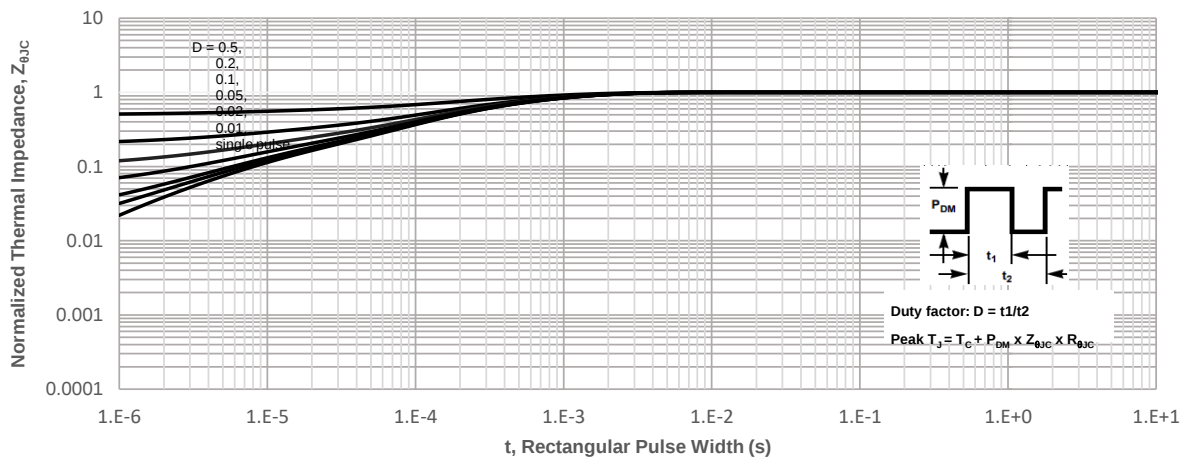
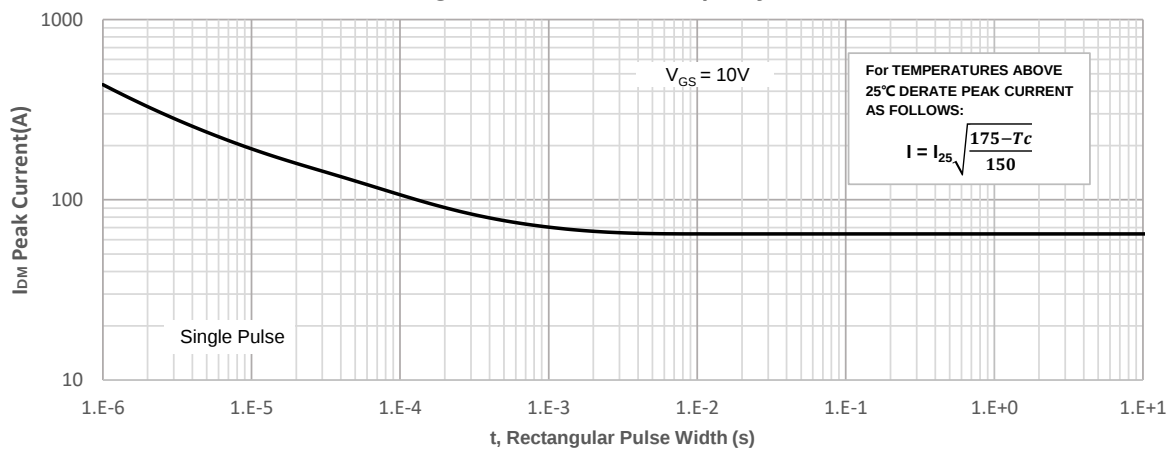
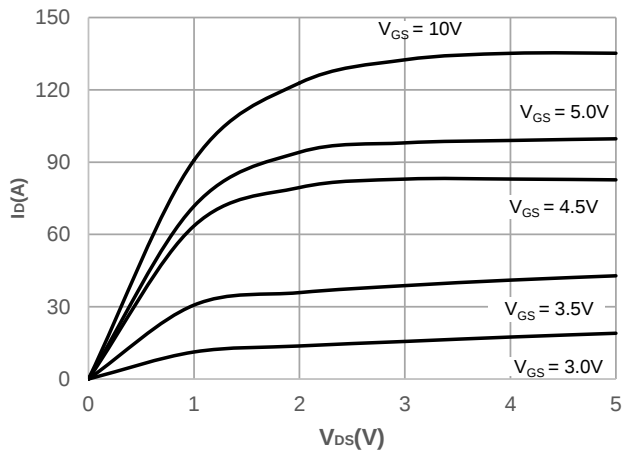
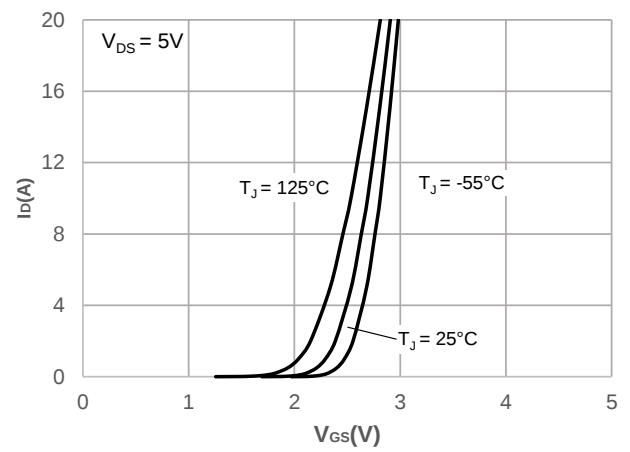
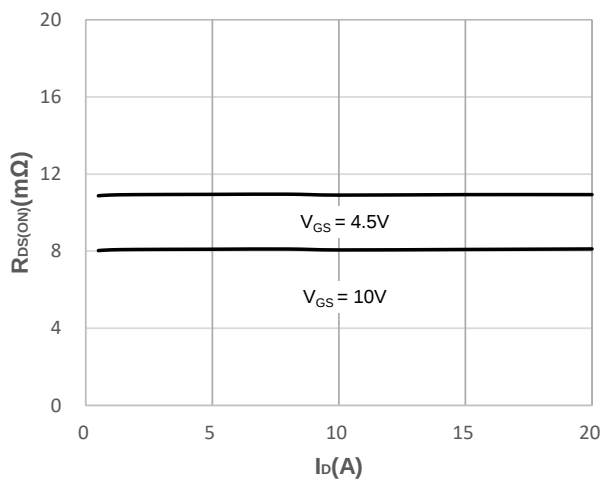
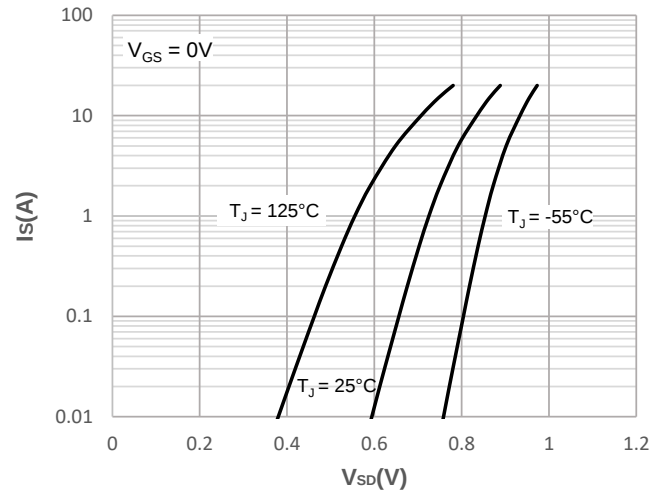
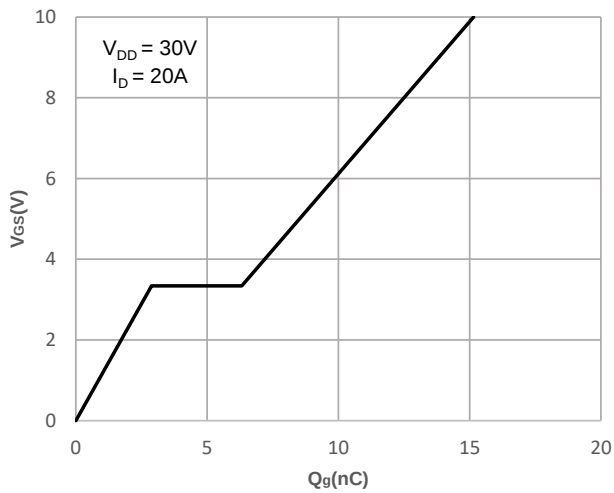
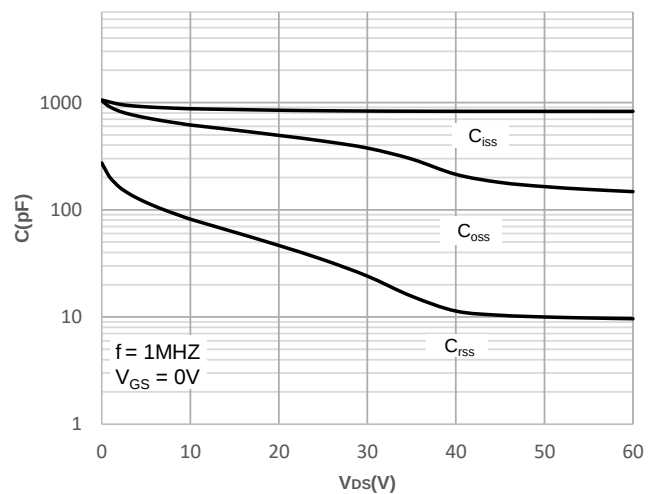


Figure 4: Peak Current Capacity



Typical Performance Characteristics

Figure 5: Output Characteristics

Figure 6: Typical Transfer Characteristics

Figure 7: On-resistance vs. Drain Current

Figure 8: Body Diode Characteristics

Figure 9: Gate Charge Characteristics

Figure 10: Capacitance Characteristics


Typical Performance Characteristics

Figure 11: Normalized Breakdown voltage vs. Junction Temperature

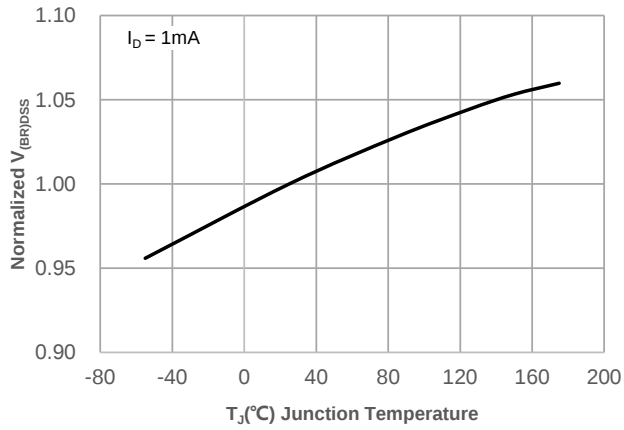


Figure 12: Normalized on Resistance vs. Junction Temperature

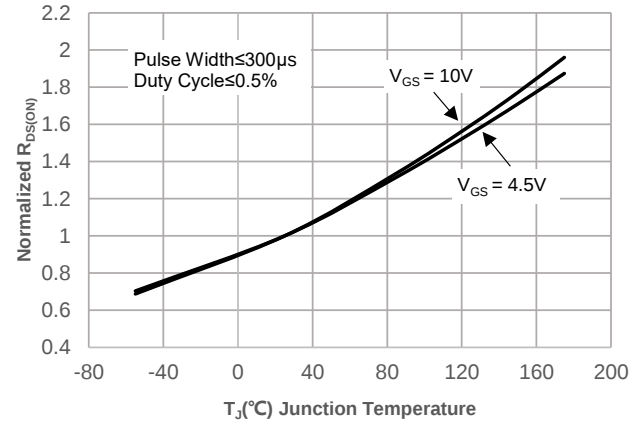


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

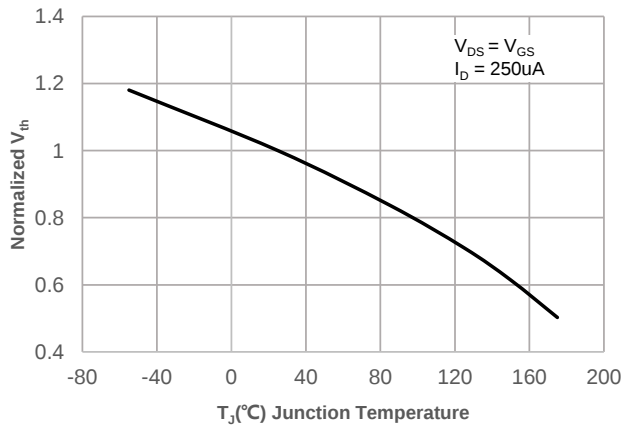


Figure 14: $R_{DS(ON)}$ vs. V_{GS}

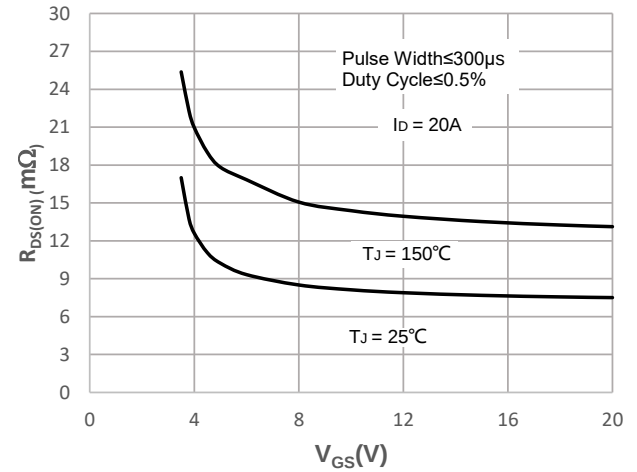
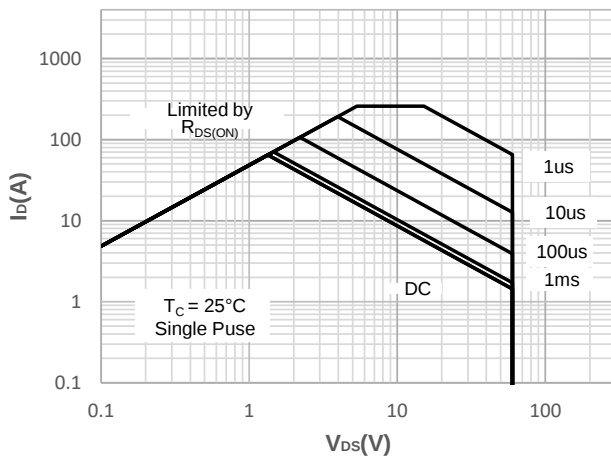


Figure 15: Maximum Safe Operating Area



Test Circuit

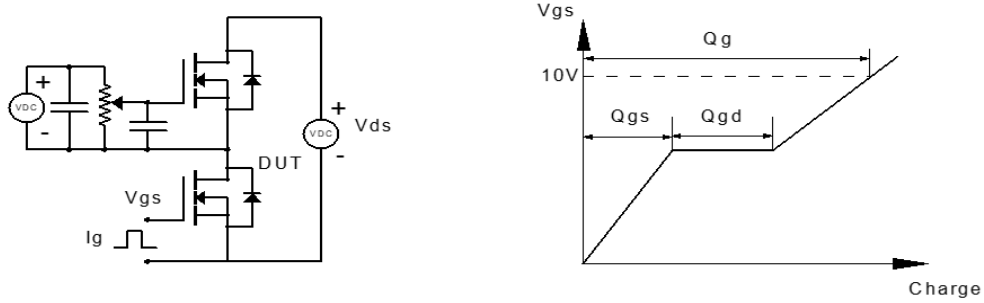


Figure 1: Gate Charge Test Circuit & Waveform

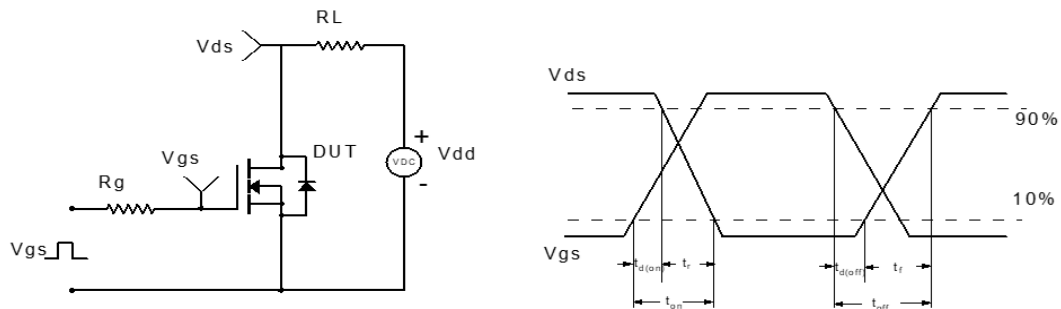


Figure 2: Resistive Switching Test Circuit & Waveform

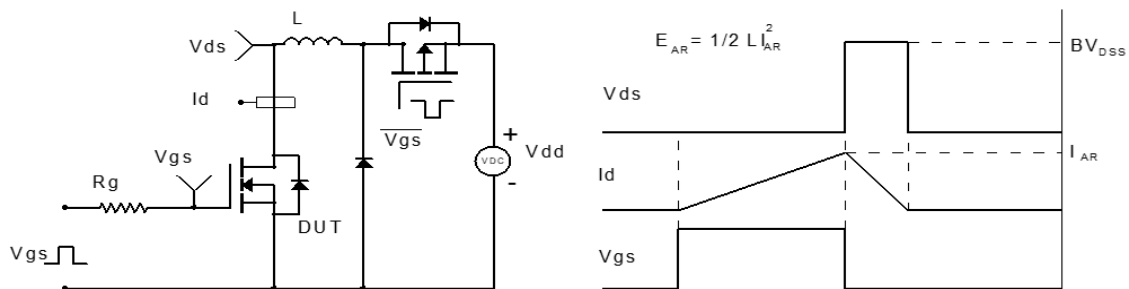


Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

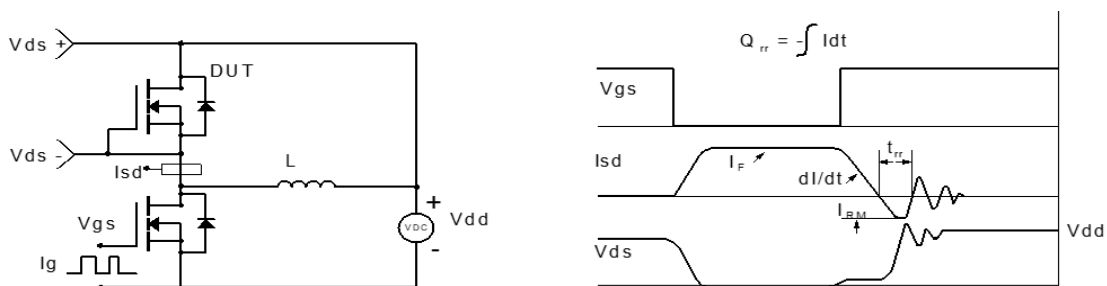
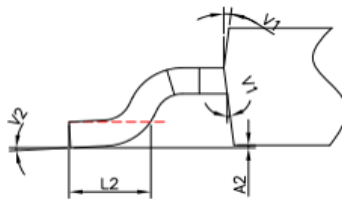
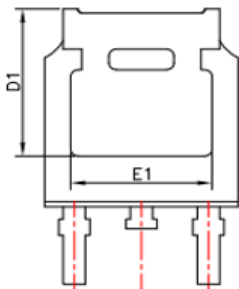
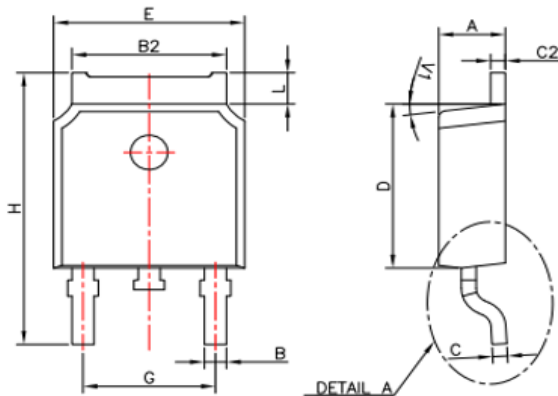


Figure 4: Diode Recovery Test Circuit & Waveform

Package Mechanical Data(TO-252-3L)

Package Outline



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.10	2.30	2.50	0.083	0.091	0.098
A2	0	---	0.15	0	---	0.006
B	0.66	0.76	0.86	0.026	0.030	0.034
B2	5.18	5.33	5.48	0.202	0.210	0.216
C	0.40	0.508	0.60	0.016	0.020	0.024
C2	0.44	0.508	0.58	0.017	0.020	0.023
D	5.90	6.10	6.30	0.232	0.240	0.248
D1	5.30 REF			0.209 REF		
E	6.40	6.60	6.80	0.252	0.260	0.268
E1	4.826 REF			0.19 REF		
G	4.47	4.57	4.67	0.176	0.180	0.184
H	9.50	10.10	10.70	0.374	0.398	0.421
L	0.95	1.16	1.30	0.037	0.046	0.051
L2	1.35	1.50	1.65	0.053	0.059	0.065
V1	---	7°	---	---	7°	---
V2	0°	---	6°	0°	---	6°

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